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Ueber den Einfluss einer Sinneserregung auf die übrigen Sinnesempfindungen. VICTOR URBANTSCHITSCH. Pflüger's Archiv f. d. ges. Physiologie, XLII, 3-4, 1888.

The well known cross-associations between the senses, by which, for example, a piercing tone calls up a red color, etc., and of which Bleuler, Lehmann and Mr. Galton have given so able descriptions, suggested to the author an experimental investigation of the influence of a sense impression through one sense upon that through another. In particular he asked if one sense organ is stimulated with the smallest stimulus that will arouse a definite sensation of a certain kind, will the simultaneous excitation of another sense organ have an influence, favorable or otherwise, upon the perception of the first? This question he answers in the affirmative for almost every type of sensation. It will only be necessary to sample his observations here and there, asking the reader to remember that almost any pair of sensations that he selects will have a similar influence to that described.

(1.) Patches of color are seen at a distance at which the color can scarcely be made out; a tuning-fork is sounded and the general result is that colors formerly not visible are brought into the sensory field; as Fechner would state it, the threshold is lowered. Tuning-forks applied to both ears, high-pitched forks, are most influential; and wide individual variations characterize all the results, in some cases even reversing the usual result. The influence upon different colors is also variable. Barely legible print is often read when a sound accompanies the effort. Sounds similarly influence smells, tastes, and touches; the increase of pain by a jarring noise being brought under the last head.

(2.) A sound has its intensity decreased if the eyes be closed, increased if the illumination be brightened. Colors have a strong effect. In one case the ticking of a watch was made more distinct by the sight of red and green, less distinct by that of blue and yellow. The influence of sights upon musical tones is marked and various, the effect being different for high from what it is for low tones. Musically gifted persons show these phenomena best. Another curious phenomenon is the localization of tones in different parts of the person, transversely along the head in one case; and this arrangement, though very different from individual to individual, is remarkably constant in any one case. Sights also affect subjective noises, as the rushing in the ears, and stranger still, the effect of an impression upon one eye influences the sounds in the ear on the same side decidedly more than the other. The rapidity with which these effects arise and die out is also very variable, and some time measurements are noted. The influence of sights upon smell is difficult to detect, but upon taste is marked. Sensations of temperature, as also of pain, are increased by increase of illumination. Complementary colors seem to have a similar influence. The effects of color upon animal development and upon psychic conditions as Goethe suggested are also cited as relevant.

(3.) Smell has very slight reinforcing power over other senses, but is most marked with sounds.

(4.) Taste has greatest influence over colors, but no law is evident.

(5.) The influences of temperature and tactile sensations upon usual ones are very interesting, and especially so is the statement that the stimulation by heat or cold of one skin area decreases the tactile sensibility of another area, while a tactile stimulation has a favorable effect upon a temperature sensation.

Finally the author succeeded in producing the "photisms" or "sound colors," by having the subject look at a gray disk on white paper, and describe the color effects he perceived as different forks were sounded—a very important contribution to the subject. The persons who see colors when they hear sounds, or *vice versa*, are thus only marked examples of a normal physiological reaction of one sense upon another.

While the author has here made an important contribution to an obscure field of research, much corroboration of his results will be necessary before they can stand as final; his special laxity is in regard to objective tests (many of which suggest themselves) of the real nature of these peculiar sensory associations.

J. J.

Neue Experimente über den Vorgang der einfachen Reaction auf Sinnes-eindrücke. LUDWIG LANGE. Wundt's Philos. Studien, IV, 4, pp. 479-511.

The chief contribution of this paper consists in the introduction of a new distinction in the analysis of psychic processes. While various observers have called attention to the fact that the psychic process in a simple reaction time was not always the same, they regarded the differences as mainly due to the effects of practice and normal individual variations, and they sought by taking the average of all reaction times to get a single result true for the average individual. Lange, on the contrary, holds that there are normally two methods of reacting to a simple sensory stimulus, which he distinguishes as "motor" and "sensory." In the "motor" type one does not think of the sense impression, but has the attention focused upon the preparation of the motor reaction; while in the "sensory" type every tendency to get the motion ready is avoided, the attention being directed to the sensory impression entirely; when the impression is received the reaction is to follow as soon as possible. These two types are of course perfectly distinct only in their extreme forms, and can be studied only in individuals of steady and self-possessed mental habits. Lange's object was to study the difference between "sensory" and "motor" reaction times in their extreme types. The sense impression was a sound preceded at a variable but controllable number of seconds by a "signal"; a further condition that seems to have worked admirably was the separation of operator and subject in different rooms and in communication by a telegraphic code. The interval between signal and stimulus was chosen for each individual at from one to three seconds according as seemed favorable to the quickest reactions. For three observers the average time of a reaction of the extreme "motor" type was .125, .137 and .123 second, while for the extreme "sensory" type it was .223, .224 and .230 second. The difference in time between the two is thus nearly .1 second, and the average variation of the several times from their mean is also larger in the "sensory" type. The "motor" is nearer the automatic stage, is probably less subject to individual and other fluctuations, while the "sensory" is nearer the conscious voluntary type of action. Furthermore, the reactions in anticipation of the sense impression never occur with the "sensory" type, but are difficult to avoid in "motor" reactions, because the point on which the attention is fixed tends to get first realized. Again, if a stimulus of an unexpected and totally different kind be given, it will always be reacted